

**OPPT Strategy to Understand Fluorination of  
Plastic Containers used in non-FIFRA, non-FDA Applications  
7 April 2021**

**Goal:**

Obtain information to better understand the extent that container fluorination is a practice used in non-FIFRA, non-FDA applications and can result in PFAS contamination.

*All activities in the plan below will be completed by DGAD/SPPB staff.*

**Objective 1: Collaborate and collect information across EPA to ensure we are efficiently working together**

- **Activity 1: Collaborate with ICB**
  - Short-term action: set up meeting with ICB regarding the findings of their chemistry report and share information to ensure understanding of the chemistry, information they have on impacted plastic and container types, or other issues they may be working on.
    - Timeline: meeting will be scheduled within the next two weeks.
  - Long-term action: establish channels for routine communication and hold meetings with ICB as needed to share information
    - Timeline: Ongoing
- **Activity 2: Participate in weekly OCSPP/OECA PFAS check-in meetings**
  - Action: Continue to attend weekly calls and will present any new findings at the check-in calls as needed.
    - Timeline: Ongoing
- **Activity 3: Collaborate with Thuy Nguyen (Branch Chief of OPP/BEAD/Analytical Chemistry lab)**
  - Short-term action: Meet with Thuy regarding the findings and status of her research, which will help to understand the types of plastic containers being tested (helps to inform conversations with external stakeholders).
    - Timeline: Complete
  - Short-term action: To help understand the scope of the issue, identify 2-3 additional container types for testing that are routinely used in manufacturing or commerce and set up a follow-up meeting with Thuy to discuss the feasibility of testing additional product containers.
    - Timeline: By May 1<sup>st</sup>, 2021
  - Long-term action: Thuy will perform testing on additional product containers identified for testing. Additional containers may be tested in future, depending on results.
    - Timeline: Initial goal is fall 2021
- **Activity 4: Review the private sector product sustainability standards included in the EPP program's Recommendations of Specifications, Standards and Ecolabels as well as the Safer Choice Standard**

- Short-term action: Review private sector sustainability standards and the Safer Choice Standard to determine if there are existing criteria to address the fluorination of plastic containers.
  - Timeline: Complete. No existing criteria were found within the standards to address the fluorination of plastic containers.
- Long-term action: EPA may wish to consider advocating for updates to private sector standards to have criteria added and/or encourage the development of new private sector standards. EPA may wish to include fluorination-related criteria in the Safer Choice Standard (typically changes to the standard are made through public notice and comment.)
  - Timeline: Next 1-5 years as standards become eligible for updates; shorter-terms for Safer Choice if desired.
- **Activity 5: Explore if OLEM has information of the potential for PFAS contamination from recycled fluorinated containers, and whether there is a nexus with OLEM's Circular Economy Strategy (tentatively scheduled to be released on Earth Day)**
  - Short-term action: Email OLEM contacts in charge of developing and implementing the Circular Economy Strategy to explain the issue and the inquire possible impacts to the recycling system.
    - Timeline: Complete
  - Long-term action: Work with OLEM to address this issue, and how one might test recycled plastics (i.e., HDPE) and, possibly, containers from recycled plastic which were not intentionally fluorinated, to see if they demonstrate PFAS contamination.
    - Timeline: OLEM implementation plan development to begin shortly after the release of the strategy on Earth Day (4/22).

**Objective 2: Within the bounds of the Paperwork Reduction Act (PRA), initiate information/outreach to private sector contacts**

Example Questions for Stakeholder Calls:

- Are they aware of the issue? If yes, what are their plans or actions to understand the extent of the issue and to address the issue?
- What are the types of plastic containers that are typically fluorinated?
- Who is doing the fluorination?
- Who manufactures the plastic containers?
- Are container customers (business-to-business) involved in requesting customized fluorination specifications?
- What is the extent to which fluorination occurs?
- What are the fluorination conditions that influence formation of PFAS, including products that may pose a concern?
- What are alternative technologies, processes, or materials that can be used as alternatives to fluorination of containers?

- **Activity 1: Meet with the State of Massachusetts' testing lab regarding their lab testing of fluorinated containers.**
  - Short-term action: P2 staff met with Mark Smith (Mass. lead for lab research) to learn about their findings related to fluorinated containers and the scope of their future research.
    - Timeline: Complete
  - Long-term action: Set up a follow-up meeting with Mark to learn of any new findings and exchange information.
    - Timeline: Meeting will be set up in June 2021
- **Activity 2: Meet with ACC**
  - Short-term action: Set up a meeting with ACC (Rob Simon) to learn about their outreach/information gathering efforts on the extent of fluorinated plastic container use in the industrial/commercial/consumer chemicals sector.
    - Timeline: David W. has contacted Rob Simon to set up meeting
  - Long-term action: TBD based on the call
    - Timeline: TBD
- **Activity 3: Meet with The Household and Commercial Products Association (HCPA)**
  - Short-term action: Initial meeting to understand plans for Spring Meeting. HCPA will have a session on fluorination. Unknown if the meeting will be open to EPA. Key contacts: Steve Bennett and Nicholas Georges.
    - Timeline: Complete
  - Short-term action: Set up a second meeting with key contacts to understand developing knowledge of the issue.
    - Timeline: by May 31<sup>st</sup>, 2021, after the HCPA Spring Meeting
  - Long-term action: Understand the container types in HCPA space that may be fluorinated (could include raw materials and fragrances).
    - Timeline: Summer, 2021
- **Activity 4: Meet with the American Cleaning Institute (ACI)**
  - Short-term action: Set up a meeting with key contacts (Kathy Stanton and Jim Kim)
    - Timeline: by May 31<sup>st</sup>, 2021
  - Long term action: To understand the container types in ACI space that may be fluorinated, the extent of the use of fluorination, and what their members are doing to address the issue.
    - Timeline: TBD based on initial conversation
- **Activity 5: Meet with fragrance sector trade association (IFRANA or Fragrance Creators Association).**

*Note: We would ask about the association's understanding of fluorination of containers used for fragrances, solvents, and antioxidants. This is an area of importance; from product manufacturers and their associations, we understand that fragrances can dissipate through or be absorbed or adsorbed by plastics.*

- Short-term action (possibly): We may choose to engage through product manufacturers before engaging with the fragrance sector trade associations. Based on those

conversations, possibly set up a meeting with key contacts in the fragrance industry (key contact: Farah Ahmed).

- Timeline: Early summer

- Long-term action: Continue to engage with the key contacts identified above to understand how fluorinated containers may be necessary in the fragrance industry for transportation and storage of fragrance chemicals and ancillary components such as solvents (carriers).

- Timeline: TBD

- **Activity 6: Identify and Meet with leadership product manufacturing companies**

- Short-term action: Set up meetings with larger companies who are likely to understand or want to understand the scope of fluorination of their product containers (e.g., have had a conversation with Seventh Generation, who is promoting efforts in ACI to better understand the situation). Will identify and set up meetings with a small number of additional companies.

- Timeline: by May 31<sup>st</sup>, 2021

- Long term action: Stay abreast of activities and state of the knowledge at leadership companies

- Timeline: Summer and as needed.

- **Activity 7: Meet with Sustainable Packaging Coalition**

- Short-term action: Set up a meeting with SPC to learn about the state of their knowledge on fluorinated plastic container use in the industrial/commercial/consumer chemicals sectors and any action they are contemplating.

- Timeline: Meeting set for April

- Long-term action: TBD based on the call

- **Activity 8: Identify and contact additional trade associations and companies who may be focused on container production and treatment.**

- Short-term action: Gather a list of trade associations and organizations and research their ability to credibly represent the space. Gather information on the trades' understanding of the issue, knowledge regarding the types of plastic containers that may be fluorinated, extent of their use and whether they have plans to address the issue.

- Timeline: By May 1<sup>st</sup>, 2021 (see Appendix B for organizations that have already been identified).

- Long-term action: Set up meetings with an appropriate subset of the trade associations and organizations on the list in Appendix B.

- Timeline: Fall 2021

- **Activity 9: Consideration of possible TSCA section 8(a) rule to collect information from identified organizations or specific non-FIFRA/non-FDA product manufacturers or container manufacturers.**

- Short-term action: Begin management discussion of the feasibility of using TSCA Section 8(a) rule.

- Timeline: May 31<sup>st</sup>, 2021

- Long-term action: Issue TSCA section 8(a) rule and analyze the information we collect and determine next steps.

- Timeline: TBD

## Appendix A: Background of the issue and chemical process (useful to conduct informed outreach)

### Chemical Process

The following summary was informed through company information and the conversation with Thuy Nguyen (Branch Chief of BEAD's Analytical Chemistry lab). It is in alignment with the chemistry report developed by ICB.

- Fluorination is primarily through reaction of the plastic container's polymers with fluorine gas (F<sub>2</sub>) under elevated temperature and pressure. In this process, fluorine atoms replace hydrogen atoms of the polymer's methylene (-CH<sub>2</sub>-) groups resulting in -CF<sub>2</sub>- groups. Possible proprietary elements of the process include the addition of oxygen gas (O<sub>2</sub>) and likely vary among companies offering this service. Companies offering fluorination advertise degrees of fluorination – some from 1-5 and others from 1-9. Presumably the higher number indicates a higher degree of fluorination.
- Polypropylene, polyethylene, and PVC may be fluorinated because these plastics have methylene (-CH<sub>2</sub>-) groups. Polyethylene terephthalate (PET or PETE) does not contain methylene groups and cannot be fluorinated by the method described above.
- High-density polyethylene (HDPE) carbon chain lengths are typically around C<sub>2,000</sub>. Shorter chain impurities (C<sub>20+</sub>) are common. During the fluorination process breakage in the polymer chain can lead to fluorination of the shorter chain polymer fraction and formation of PFAS impurities. OPP analysis has shown that these PFAS impurities, in the C<sub>4</sub> to C<sub>14</sub> range, leach into rinsate.

### Appendix B: Draft List of Trade Associations and Organizations that we may wish to meet with:

- National Association for PET Container Resources: [ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fnapcor.com%2F&data=04%7C01%7CClarkin.jenna%40epa.gov%7Cd194b4b381074fb6df4108d8f93c4e21%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637533384705837443%7CUnknown%7CTWFpbGZsb3d8eyJWljojMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IklhaWwiLCJXVCi6Mn0%3D%7C1000&sdata=nKNnyVpBuHNR%2FmtU5QRK77JuYXSUWMUGs9IUC08EckS%3D&reserved=0" ]
- Association of Plastic Recyclers: [ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fplasticsrecycling.org%2Fabout&data=04%7C01%7CClarkin.jenna%40epa.gov%7Cd194b4b381074fb6df4108d8f93c4e21%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637533384705837443%7CUnknown%7CTWFpbGZsb3d8eyJWljojMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IklhaWwiLCJXVCi6Mn0%3D%7C1000&sdata=X6vf%2FQN8CUE%2BXPz4S5KUXoC6MpfprCdl3aUzkoDW8Ok%3D&reserved=0" ]
- Plastics Industry Association: [ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.plasticsindustry.org%2F&data=04%7C01%7CClarkin.jenna%40epa.gov%7Cd194b4b381074fb6df4108d8f93c4e21%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637533384705837443%7CUnknown%7CTWFpbGZsb3d8eyJWljojMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IklhaWwiLCJXVCi6Mn0%3D%7C1000&sdata=8tThUiRhRWo%2BIVQQABp8bVtXLFRobe4VCAGROhlmuy0%3D&reserved=0" ]

- Part of the Plastic Industry Association is the Processors Council: [ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.plasticsindustry.org%2Fsupply-chain%2Fprocessors-council&data=04%7C01%7CClarkin.jenna%40epa.gov%7Cd194b4b381074fb6df4108d8f93c4e21%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637533384705847400%7CUnknown%7CTWFpbGZsb3d8eyJWljoIMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IjEhaWwiLCJXVCI6Mn0%3D%7C1000&sdata=EM5%2F2fxRJK%2B7WYPMrD5cR%2BGYQLwG3pOOgx%2FDiOPREwQ%3D&reserved=0" ]
- National association of Container Distributors: [ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fnacd.net%2F&data=04%7C01%7CClarkin.jenna%40epa.gov%7Cd194b4b381074fb6df4108d8f93c4e21%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637533384705847400%7CUnknown%7CTWFpbGZsb3d8eyJWljoIMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IjEhaWwiLCJXVCI6Mn0%3D%7C1000&sdata=tGuxkUY8dZddFBG%2BGzyhAiXHjE0FScVUGaK2HQTi3QE%3D&reserved=0" ]
- Carpet Recovery (using recycling plastics for making new carpet): [ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fcarpetrecovery.org%2F&data=04%7C01%7CClarkin.jenna%40epa.gov%7Cd194b4b381074fb6df4108d8f93c4e21%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637533384705857356%7CUnknown%7CTWFpbGZsb3d8eyJWljoIMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IjEhaWwiLCJXVCI6Mn0%3D%7C1000&sdata=zQfgDPYdkyuyKY0Xfgr2SLwbXWehCfNx28qoHfykOUk%3D&reserved=0" ]
- Pak-Logic: packaging consultancy business forwarded by Kimberly Nesci (OPP): <http://www.pak-logic.com/>

#### Appendix C: List compiled by the Industrial Chemistry Branch of possible plastic suppliers,

- The Cary Company - Offers a fluorinated barrier treatment that appears to be similar to Inhance Technologies. The website is light on details but it does indicate that the entire container (i.e. inside and out) is coated which indicates it is likely a gas phase processes.  
[ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.thecarycompany.com%2Fservices%2Ffluorination-barrier-treatment&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038404469%7CUnknown%7CTWFpbGZsb3d8eyJWljoIMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IjEhaWwiLCJXVCI6Mn0%3D%7C1000&sdata=T4s%2BGtoKCWgM2TEoAKC8nz6YkPMwNlm8xbXDLYDCuPg%3D&reserved=0" ]
- Berlin Packaging – Advertises fluorinated barrier treatment for plastic products that can undergo paneling.  
[ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.berlinpackaging.com%2Ffluorination%2F&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038404469%7CUnknown%7CTWFpbGZsb3d8eyJWljoIMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6IjEhaWwiLCJXVCI6Mn0%3D%7C1000&sdata=T4s%2BGtoKCWgM2TEoAKC8nz6YkPMwNlm8xbXDLYDCuPg%3D&reserved=0" ]

WwiLCJXVCI6Mn0%3D%7C1000&sdata=a6tdOP%2BZ1f129ItQGy%2F2I4W4RGVM%2F%2FtJbA7yGYDeEcl%3D&reserved=0" ]

- Qorpak (subsidiary of Berlin Packaging) – Describes fluorinated barrier process that is similar to Inhance.  
[ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.qorpak.com%2Fpages%2Ffluorination&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038414426%7CUnknown%7CTWFpbGZsb3d8eyJWljiMC4wLjAwMDAiLCJQljoV2luMzliLCJBTiI6lk1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=dmmGaNcV1xresuuA8srqN4cMW1huyt7iexBGWexrV8c%3D&reserved=0" ]
- C.L. Smith – The company mentions that containers with a fluorinated barrier layer can be purchased. The graphic on the website mentions Enkase, which is a technology that is also advertised by Inhance. Based on this information, it appears that the Inhance does the fluorination for this company.  
[ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.clsmith.com%2Fbarrier-enhancements%2F&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038414426%7CUnknown%7CTWFpbGZsb3d8eyJWljiMC4wLjAwMDAiLCJQljoV2luMzliLCJBTiI6lk1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=g3ZxY4cW9wrU8athBe3pHTED%2FS7iQ2gbB379CL%2Bjs28%3D&reserved=0" ]
- Container and Packaging – Describes a similar fluorination process to the one used by Inhance.  
[ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.containerandpackaging.com%2Fresources%2Ffluorination-brilliant-bottle-barrier&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038424383%7CUnknown%7CTWFpbGZsb3d8eyJWljiMC4wLjAwMDAiLCJQljoV2luMzliLCJBTiI6lk1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=%2Fm7SVLIPE7SVUxTlgN2s3%2FyiPWBuEgeDy5cFG%2B5IkA0%3D&reserved=0" ]
- MJS Packaging - Can buy fluorinated containers and they describe the gas phase technology that is similar to the one used by enhance.  
[ HYPERLINK  
"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.mjspackaging.com%2Fblog%2Fbasics-of-bottle-fluorination-process%2F&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038424383%7CUnknown%7CTWFpbGZsb3d8eyJWljiMC4wLjAwMDAiLCJQljoV2luMzliLCJBTiI6lk1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=Soxv2g9pX6VIINCBOskhh%2F0dvxN0RwzYvBvEzobsZ8s%3D&reserved=0" ]
- Pretium – Offers containers with an in-mold fluorination process. Not sure of the details of this technology.

[ HYPERLINK

"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fpretiumpkg.com%2Fpretreat-in-mold-fluorination%2F&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038434339%7CUnknown%7CTWFpbGZsb3d8eyJWlloiMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6Ikl1haWwiLCJXVCi6Mn0%3D%7C1000&sdata=fnkrvFfK3GzvelawuCaP%2BkkSo%2Fk8kT1VjWn%2FeBZnH5A%3D&reserved=0" ]

- Ipackchem – Offers containers with in-mold fluorination.

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"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.ipackchem.com%2Fin-mould-fluorination%2F&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038434339%7CUnknown%7CTWFpbGZsb3d8eyJWlloiMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6Ikl1haWwiLCJXVCi6Mn0%3D%7C1000&sdata=KaWUsZpdkwAglEBgj2Efwpm6ln8C8lfKm9E3xHTF8RI%3D&reserved=0" ]

And, one company that seems to claim barrier protection without fluorine:

- Barrier Plastics Inc - Mentions specifically no PFAS used, reduces the use of fluorine gas according to website. Apparently, they use a polyamide based technology that does not appear to include fluorine.

[ HYPERLINK

"https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fbaritainer.com%2F&data=04%7C01%7CWidawsky.David%40epa.gov%7C282ab2991c4e4cf954a808d8ed47978b%7C88b378b367484867acf976aacbeca6a7%7C0%7C0%7C637520239038414426%7CUnknown%7CTWFpbGZsb3d8eyJWlloiMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6Ikl1haWwiLCJXVCi6Mn0%3D%7C1000&sdata=UEon%2BeNu%2FY7uLhN%2FSr6HzXTMauiSB2PPaVY0XiF3sEI%3D&reserved=0" ]